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Abstract

This action research project was conducted to determine if guided math paired with math stations resulted in more student growth than a traditional, whole group classroom. The topic was chosen because of the researcher's interest in elementary mathematics. Some teachers are implementing math stations and guided math in schools while other teachers believe in a whole group, traditional setting. The researcher has been teaching for five years, and her class of 5th grade students participated in the action research. This researcher and another 5th grade teacher implemented guided math paired with math stations for four weeks over a long division unit. Two other 5th grade teachers taught their students long division using a traditional, whole group method. A pre and posttest was given to all students to see if guided math resulted in more student growth than a traditional classroom. The results showed guided math paired with math stations did not result in more student growth than a traditional classroom, but other benefits resulted from the guided math model. Students in a guided math classroom had a higher average mean, the achievement gap was lessened, and students were able to grow in their collaboration and technology skills.

Keywords: math stations, guided math, blended learning, small groups, cooperative learning

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Does Guided Math Paired with Math Stations Result in More Student Mathematical Growth Than Traditional Whole Group Structure?

An academic concern is sweeping the United States. Are students prepared to enter and compete in the global economy? This concern is based on low scores students achieved, specifically in mathematics and science (Rubenstein et. al, 2015). Teachers need to prepare students to enter the real-world by providing instruction resulting in proficient scores. The problem is every student is vastly different. It is not possible to teach the whole class and expect every student to understand and learn at the same pace. How can teachers prepare students for the future, while also making sure each student's needs are met?

One hundred and seven students attending a private school in South Dakota represent a wide range of learners. According to the fall 2021 NWEA math data, 45 students scored in the 80% and above category. The data also showed 9 students scored in the low or low average category, which is below 40% (NWEA, 2022). This is a general example of all schools and classes in our nation. Due to a wide range of learners in the classrooms, the students are impacted by the lack of differentiation in instructional strategy. Guided math, paired with math stations could be a solution. This would allow students to meet in small groups, while also being able to collaborate with other students and learn through technology during math stations. Little research is available to support differentiation, specifically, guided math in the elementary.

The purpose of this action research project is to determine if guided math, paired with math stations, has an effect on students' mathematical growth. Throughout this action research study, students were grouped into small groups based on ability level, worked through daily math stations, collaborated with other students, and used technology to practice their math knowledge. The goal of this study is to see if guided math paired with math stations results in more student

mathematical growth compared to students who are in a traditional whole-group math class. Teachers can use this study to determine how they will be teaching math to their own students.

Articles and research published in the last ten years were used in this action research paper. Research was mostly obtained from databases through DeWitt Library at Northwestern College in Orange City, Iowa, but a few were also found through Google Scholar. All research and articles used were also peer-reviewed. These articles were chosen because they pertained to either blended learning, small groups, flexible/ability grouping, cooperative learning, or station rotation. All these topics relate to the research question: Does guided math, paired with math stations, result in increased student growth compared to the traditional, whole-group model?

The principal findings show guided math, paired with math stations, does not statistically result in significant more growth than the traditional, whole group model, but students in a guided math classroom did have a higher mean score than students in a traditional classroom. The achievement gap between high achieving students and struggling students was also lessened in a guided math classroom compared to a traditional classroom. This result came from quantitative data from a pre and posttest over a four-week division unit in fifth grade. Even though there was not a significant more amount of growth, guided math and math stations can promote more skills whole- group instruction cannot. These skills include collaboration, technology knowledge, and independence.

Three major themes are present in guided math and math stations. These themes which are researched and discussed throughout the literature review include small groups, blended learning, and cooperative learning. Small groups are used during guided math, blended learning is integrated during math stations, and cooperative learning is implemented during guided math

and partner work in math stations. Throughout this action research paper, research and data will show the positive effects of the three themes on students, and their effects shown in previous world-wide studies.

Review of the Literature

Blended Learning

The impact of blended learning on academic performance has been well-researched. In the studies discussed in this action research paper, blended learning can be as simple as using technology in class, or it could be more complex where students are completing part of their learning in a classroom and another part online in a different setting. No matter the definition, all the studies presented show benefits of blended learning.

Research has been conducted from the elementary level to the college levels. College students see a significant benefit of blended learning. According to a study by Frederique et. al. (2020), 80% of students agree blended learning increased engagement with teachers and other staff. 92.4% of students felt the benefits of working at their own pace. 81.8%-83.4% of students felt like the online activities prepared them well for in-class activities, which made the students feel more confident going into class. Even though these are all positive factors of blended learning, one negative factor emerged from in the survey. The survey of the 66 2nd year undergraduate students at an Australian university suggested interactions with their classmates were less frequent and of lower quality. The questions focused on peer interactions had a lower mean of 2.8 compared to the highest mean of 3.2 (Frederique et. al., 2020). As a whole, this study proved the benefits of blended learning, but also showed students do not have as many peer interactions.

Another quantitative study of 110 students who attended Atilim University in Ankara, Turkey, showed benefits of blended learning (Eryilmaz, 2015). This study focused more on if online, face-to-face, or blended learning was most effective. According to the data, students have more positive opinions for blended learning compared to the other environments. Eryilmaz

(2015), averaged scores of a questionnaire given to students. The average score of the face-to-face learning environment was 2.63, online environment was 2.67, and the average of blended learning was 1.94. The lower the score, the more positive the results. This study proved the students found blended learning to be useful and students had a more positive experience.

Students in universities and colleges saw the benefits of blended learning, but so did students in elementary schools. Eighteen fourth grade students in an urban city in southwestern United States used math apps to see if it improved student learning (Zhang, et. al., 2015). These fourth-grade students took a pre-test, used the specific math app for the lesson, and then took a post-test. Three pre/post tests were given. For the first assessment, students scored a 12.4 on the pretest and then scored a 16.9 on the post-test. On the second assessment, students went from a 10.7 to a 12.5. Another post-test was given, and the average mean was 14.5. On the last assessment, students went from a 7.7 on the pre-test to a 9.9 on the post-test. This study proved math apps can improve student learning. Another result derived from the study was the benefit of students receiving instant feedback from the apps. Math apps can help students practice a new skill and bridge the gap between struggling and on-grade level students.

According to Musti-Rao & Plati (2015), third grade students also had more growth due to the use of iPads in math. In this study, 12 third grade students completed Detect, practice, repair (DPR) intervention and iPad interventions. The results showed students had about 18.5 responses per minutes on the iPad compared to 8.5 responses per minute in the DPR condition. By the end of the interventions, students were averaging 49.1 digits correct per minute on the iPad and 41.1 digits correct in the DPR condition. At the beginning of the study, seven students performed at their frustration level and five were at their instructional level. At the end of the iPad study, ten students were at their mastery level and two students moved to their instructional level. This

study revealed students had more growth using iPad interventions compared to the DPR intervention. IPads can be a huge benefit in the classroom and help students grow in their math knowledge.

This data shows technology can provide benefits to students, but how do we know the technology is causing growth and not the content? According to Dietrich & Balli (2014), 34 students from six different fifth-grade classrooms were interviewed about technology in the classroom, and the results suggested students were more engaged because of the technology and not the content. The results of the interviews showed major themes. Students mentioned iPads gave them more control and felt more like play and not work. Students enjoyed using computers because they had the control to find information out for themselves, and they were able to be independent and receive instant feedback. Throughout the interviews, students never mentioned what they were learning. They only mentioned the technology tools. Therefore, this shows technology was the driving factor of engagement, not the content. This study showed technology can engage students in a way which teachers cannot. The results of the interview also showed control, choice, and real-life tasks can also spark student interest.

These studies show the benefits of a blended learning environment. Technology can engage students, provide instant feedback, reinforce skills, and allow more interaction with the teacher. Because of the benefits, blended learning can help students grow and bridge the gap between struggling learners and on-grade level students.

Small Groups

Research has shown small group settings can benefit student learning. Even though data in research supports small group settings in education, teachers have many different reactions and beliefs.

According to a study by Aftab (2015), 95% of teachers were willing to try out differentiated instruction, which involved making smaller groups of students based on needs and abilities. This study involved 120 middle school teachers in private schools in Karachi. Even though 95% of teachers were willing to differentiate, only 40.8% of teachers actually implemented differentiated instruction. This uncovers a gap in actual implementation. In this study, 92.5% of the teachers believed administrators supported differentiation, 83.3% of the teachers believed students supported differentiated instruction, 92.5% believed parents supported it, and 80% believed other teachers believed their teaching colleagues supported it. If teachers in this study knew differentiation had so much support, why were more teachers not implementing it? The results showed only 15% of the teachers believed they had enough time to plan for differentiation. Therefore, one main reason for the gap of teachers being willing to try differentiation and teachers actually implementing it was time restraint.

In a study by Webel and Dwiggins (2019), 88 elementary pre-service teachers were asked how ability grouping in math was perceived in the past and how their views on ability grouping were perceived as they were heading into the education field. According to the results, many of the pre-service teachers were impacted by ability grouping. Ability grouping impacted how the pre-service teachers identified themselves at a young age, and it impacted how they viewed math. 37 of the teachers experienced ability grouping before 6^{th} grade, but only 18 out of the 88 had mostly positive views about ability grouping. Looking at what ability group the students were in, six students in the high ability group had positive views, while 14 in the high ability group had negative views. Five students in the low ability group had positive views, while ten in the low group had negative. In the mixed ability group, two students had positive views, while 15 students had negative views. When asked what the pre-service teachers were seeing in their

host teachers' classrooms, 49 students saw ability grouping happening in the classrooms. Out of these 49 pre-service teachers, 24 of them supported the host teacher's decision to use ability grouping.

43 schools from 12 different states had teachers take surveys to see how teachers react to pre-differentiated and enriched math curricula (Rubenstein et. al., 2015). According to the results from the surveys, teachers saw the benefits of using preassessments to gauge student understanding. They used the results from the preassessments to group students. 86% of teachers agreed preassessments were beneficial and helped group students. The preassessments also helped teachers know what students understood, which helped them know what to teach in small groups. Even though the teachers saw benefits from pre-differentiated curricula, the teachers felt a fear from going away from the district curricula. Teachers felt like if they did this, students would not be prepared for state testing.

Even though teacher beliefs about small ability groups are different, data from research shows small group setting promotes student engagement. In a study by Alvi & Nausheen (2019), five grade nine male students had to use mathematical problem solving while working alone versus working with a small group. The findings showed students sought answers from each other in language everyone in the group understood. Students also seemed more engaged in the group setting rather than working individually. Students were actively engaged in conversation and asked for help from their peers.

Significant research also has been conducted to see how small group setting impacts elementary students. According to a study by Gaffner et. al. (2014), 1st -4th grade students reading below grade level participated in a guided reading clinic. In this clinic, students worked in a small group with a preservice teacher. One group met for one semester and another group

met for an entire year. Data was collected from pre to posttest scores. According to the results, the students in the semester long group grew by one month's reading level, and the students in the year-long group grew by six months. The results also showed the importance of early intervention. As students' grade levels increased, less improvement ensued. In 1st grade, at the end of receiving intervention, the average test score was around a 1st grade level. In 2nd grade after intervention, the average score was 1.9, which is end of 1st grade level. By 4th grade, the post test score after intervention was 3.2, which is beginning of 3rd grade. All the small group intervention benefited the students, but the younger the student, the more growth they expected.

Small groups have also been used in an elementary math setting. Enu & Awortwe (2015) used pre and posttets to determine if group size had any effect on students' mathematics achievement in a small group setting. Results showed small groups improved performance of students, and the small groups allowed opportunities for learning which are not always possible in a whole group setting. The results also showed no significant difference between groups of 3, 4, or 5 students. In a group of 3, students started with a pretest average mean of about 11. Their posttest average was 14.7. In the groups of 4, the mean score of the pre test was about 9 and the posttest mean score was 17.6. The pre test average for the groups of 5 was about 12 and the posttest was 13.4. No significance difference could be claimed because the level of significance between the groups was less than 5%. Even though a significant difference could not be accepted between the groups, all the small groups showed growth.

McKeen (2019) completed a study to determine the impact of grade level flexible grouping on math achievement scores. According to the results, the effect of flexible grouping varied by grade. Students who were exposed to flexible grouping had higher scores in 1st-3rd grades, but 4th grade did not have any significant effects. The charts included in the research

indicated students in 1st-3rd grades had higher average scores after flexible grouping than before. Fourth grade students had some growth, but not as significant as students in 1st-3rd grades.

A study completed by McCollum (2019) compared a station rotation blended learning classroom to a traditional classroom using NWEA MAP data. This study looked at 115 second graders in two rural schools in southern Illinois. The results of this study showed students in the rotation model of blended learning had higher RIT (Rasch Unit) mean scores than students in the traditional model of instruction. The students participating in the rotation model also had higher growth. The students in the blended environment increased their math score by a mean of 4.77 more than the students in the traditional classroom from fall to spring scores. The students in the rotation model had an average mean of 21.62 with a standard deviation of 6.95. Students in the traditional classroom had an average score of 16.85 with a standard deviation of 7.01.

Benders & Craft (2016) completed an action research study to determine if flexible small groups affected math achievement in 1st grade. Twenty-five 1st grade students in a rural area in southern Kentucky participated in the study. All students participating in small groups had growth from the pre to posttests. Students who were below average benefited more from small group instruction compared to whole group instruction. Average students performed similarly when provided with small group and whole group instruction. Pretest results showed five students scored below 20%, one student scored 50%, and the average score of the pretest was 24.5%. After flexible small groups were implemented, a posttest was given. The posttest results showed an average score of 90.9%, with a mode score of 100%. Eleven students were "struggling" students according to the pretest. According to the posttest, six students reached the "mastered" level, while five students were in the "in progress" level.

Research was also conducted to determine if a difference existed between experimental and comparison groups with respect to overall mathematics achievement as measured by a standardized assessment (Gavin, et. al., 2013). The experimental group used a new, challenging math curriculum allowed students to work in smaller groups. The results showed the experimental group showed a mean score of 173.58, and the mean score for the controlled group was 172.41. Students who used the new curriculum scored 4.43 points higher on average compared to the students in the controlled group. As a result, students who were exposed to the new, challenging math curriculum and were also able to work in small groups had a higher average score compared to students who were not exposed to a more challenging math curriculum and did not work in small groups.

Cooperative Learning

Research shows cooperative learning during mathematics can result in higher math achievement and higher engagement for the students. In a study by Capar & Tarim (2015), the cooperative learning method was more influential than the traditional learning method for academic achievement. The general effect size was around 0.59. These results proved the cooperative learning method was more influential on mathematics than the traditional method. This 0.59 effect size is medium. Students who participated in cooperative learning also reported they had a more positive attitude towards math than students in a traditional classroom. These results came from 26 studies which took place from 1988-2010.

Research shows cooperative learning results in students staying more on-task. Hunter & Anthony (2014) looked at student interactions in small groups. This research took about six years, and the interactions took place between 8–12-year-old students. The researchers had two different categories of talk: mathematizing, which means students were talking about math

objects, and subjectifying, which means students were talking about people and what they were doing as part of their on-task actions. In the small groups, students were engaged in mathematizing conversations 41% and subjectifying 30% in the first lesson. Students were having on-task conversations about 74% of the time. In the second lesson, students were having mathematizing conversations 53% of the time, and 41% of the conversation was about others and their actions. Students were having on-task conversations 96% of the time during small groups. The results show students can be more engaged while working collaboratively with others.

In a study by Altun (2015), cooperative learning had a high effect on students' achievement. This study took place in a private middle school in Istanbul. Twenty 6th grade students participated in the study during the 2013-2014 academic year in their science/technology class. Students participated in cooperative learning to see if it affected achievement. The average achievement of a pre-test was 52.40, and the average of a posttest was 76.20. The effect value was 1.68. Because the effect value was more than 0.80, cooperative learning had a high effect on the students' achievement. Students were interviewed to determine thoughts on cooperative learning, and many themes came out of the interviews. Students stated they were able to work with students with which they normally do not interact, and they had to learn how to cooperate with them. Students discussed they were able to build on their own interests and skills because they each had their unique skills to bring to their group. Students were able to learn the content from their peers in language they could understand. The amount of discussion forced them to study more. Cooperative learning also caused students to have clearer responsibilities and expectations.

The more students participated in cooperative learning, the more positive effect the students had towards math and the more students valued math (Smith et al., 2014). 7,377 8th

grade students around the United Stated participated in the study to see how group work related to math achievement. These results showed students who participated in cooperative learning for approximately half the lessons or some of the lessons, had a higher overall mathematic achievement compared to those students who never participated in cooperative learning. Students who participated in cooperative learning for about half the lessons had a mean score of 513.96, those who participated for some lessons had a mean score of 512.09, and those who never participated had a score of 503.39. Students who participated in cooperative learning every or almost every lesson had a mean score for valuing math of 3.45 and a score of 2.73 for having a positive effect towards math. The students who never participated in cooperative learning had a mean score for valuing math of 3.25 and a mean score for having a positive effect toward math of 2.41. Therefore, not only did students have a higher achievement from cooperative learning, but also valued math more and had more of a positive attitude toward math compared to students who never participated in cooperative learning.

One study showed cooperative learning did not promote student achievement (Herrmann, 2013). During this study, 142 undergraduate students participated in cooperative learning during small group tutorials. They were given questionaries after their experience. According to the data, students did not score higher during cooperative learning compared to their normal lecture. During cooperative learning, students had an average mean score of 25.46, and an average of 25.86 during the normal presentation/lecture model. Students participated more during cooperative learning (m=18.37) compared to the presentation model (m=17.65) according to the results. Questionaries showed 27% of students had a mostly positive attitude towards cooperative learning, but 45% had a negative attitude. The tutor students studied under, had an impact on students' attitudes.

Methods

Participants

This action research is answering the question: Does guided math, paired with math stations, have more of an effect on student's mathematical growth than a traditional, whole group approach? This research was completed in four different fifth grade classrooms in a private school in South Dakota. Sixty-nine fifth graders participated in the study. Different variables are present in the study. The two teachers in the treatment group have been individually teaching less than 10 years, and the two teachers who are in the control group have been teaching more than 30 years. A math block is not blocked off in the school where this study was conducted. Therefore, all four sections of fifth grade were being taught at different times of the day. Some have math in the mornings, while other sections have math instruction in the afternoon. During math instruction, the two treatment groups had a short, whole group instruction time followed by math stations. While students were switching between math stations, the teachers were meeting with a small group of students. These small groups were determined by the results of the pretest. The control groups would provide a longer whole group instruction followed by a worksheet or practice.

Data collected for this action research project was based on pre and posttests. These tests were created by the fifth-grade teachers who participated in this study. The tests were also based on the school's curriculum, which is McGraw Hill Everyday Mathematics. December 1, 2021, was the date the pretest was given. Results of the pretest were used by the teachers to determine pacing and grouping for their classroom. About four weeks of instruction happened before the posttest was given in the beginning of January 2022.

To have fewer variables, the same person graded all pre and posttests for all four classrooms. The grader uploaded the scores into a shared document between the four teachers. Average scores were calculated for the pre and posttests in the control and treatment groups. Standard deviation and growth percentage were also identified. The growth percentage was found: (average of posttest-average of pretest)/average of posttest. The T-Test: Two Sample Equal Variance was used on the pre and post test scores to see determine if a significant difference existed between the scores of the control and treatment groups. These pieces of data can reveal a difference in growth and performance between the students in a guided math classroom and traditional classroom.

This research is standard educational practice, and no additional permission was needed. Guided math, paired with math stations, is considered a standard intervention in the building. Because this research does not adversely affect students' opportunity to learn, does not impact teacher assessment, takes place in an educational setting, and is considered normal educational practice, this research qualifies for IRB exemption.

Data Collection

This action research contains quantitative data from four 5th grade classes at a private school in South Dakota. Two of the classes implemented guided math, paired with math stations, and the other two classes were taught using the traditional, whole group approach. Before the unit started, all four classes took a pretest. The average scores of the pretest in the control groups and treatment groups were determined. At the end of the unit, students took a posttest, which was the same as the pretest. Average pre and posttest scores were compared by the researcher between the control and treatment groups. Growth from the pre to posttest in the control group was looked at by the researcher and then compared to the growth in the treatment group. The

standard deviations of the pretest and posttest of the control and treatment groups were also established. The T-Test: Two Sample Equal Variance test was used to determine a significant difference between the two groups in both the pretest and posttest.

Findings

Data Analysis

Data from 69 fifth-grade students in four different classrooms is included in this action research study. Two of the classrooms continued to complete their math block in a whole-group, traditional method (control group), and two other classrooms implemented guided math paired with math stations (treatment group). The average pre-test score for the treatment group was 44.7%, with a standard deviation of 22.9, and the average pre-test score for the control group was 36.1%, with a standard deviation of 23.6. The T-Test: Two Sample Equal Variance (p) was used to determine a significant difference between the control and treatment group in the pre-test. This test showed p= 0.1299. Since the value is greater than 0.05, the pre-test scores are not significantly different. This means the two groups have similar prior knowledge and are starting at similar levels. One group is not higher or more advanced than the other group.

The average posttest score of the treatment group was 91.1%, with a standard deviation of 10.9, and the average posttest score of the control group was 83.8%, with a standard deviation of 16.1. The T-Test: Two Sample Equal Variance was used again, and $p = 0.0277$. $P < 0.05$, which means a significant difference between the scores of the treatment and control groups is evident. Table 1 shows the difference between the average scores on the pre to post test in both the control and treatment groups. Both groups showed significant growth according to the table. The treatment group started with a little higher average on the pretest, and this continued on the posttest. The posttest average was higher in the treatment group compared to the control group. Table 2 shows the difference in standard deviation from pre to posttest in the control and treatment groups. A lower standard deviation was present in the treatment group compared to the control group on the posttest according to the table. This means the scores on the posttest from

students in the treatment group were more similar to each other, and there was less of a gap between high achieving students and struggling students.

The control group had a 57% growth rate from the pre to posttest, and the treatment group had a 51% growth rate. Even though the control group showed a little more growth than the treatment group, the control group had two students who declined on the posttest compared to the pre-test. 100% of the students grew from pre to posttest in the treatment group. The control group had three students who received 60% or below (failing) on the posttest, and the treatment group had one student who received 60% or below, which is a student on a 504 plan for math. Table 3 shows the percent of students who received a C average (75% or above) on the pretest compared to posttest in the control and treatment groups. Percents were used instead of specific numbers because the total numbers of students in the control and treatment groups differed. Thirty-two students were in the control group and 37 students were in the treatment group. Table 3 shows more students in the treatment group received a 75% or above on their pretest, and more students in the treatment group received a 75% or above on the posttest.

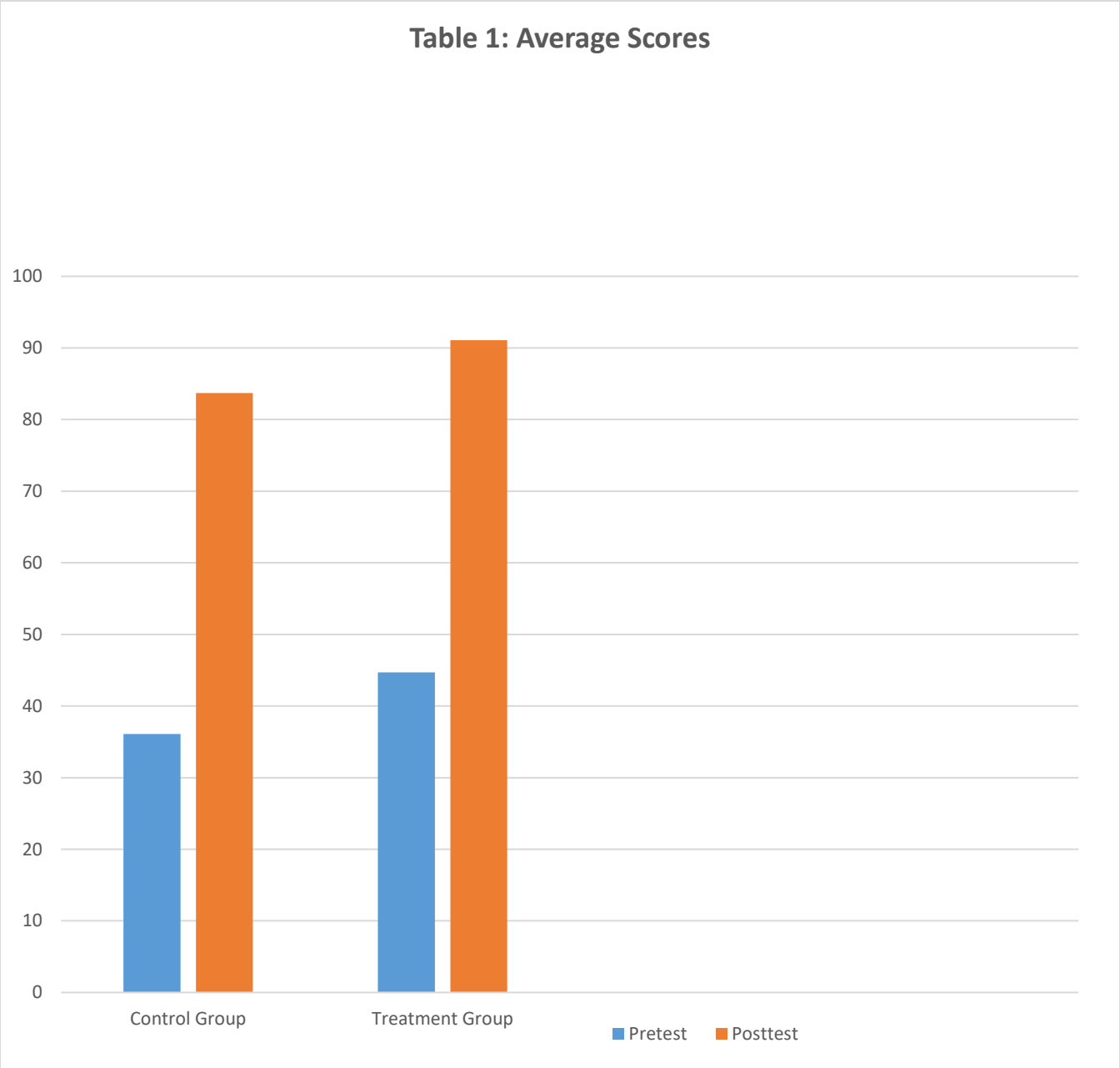
Table 1: Average Scores
100
90
80
70
60
50
40
30
20
10
0
Control Group
Treatment Group
Pretest
Posttest

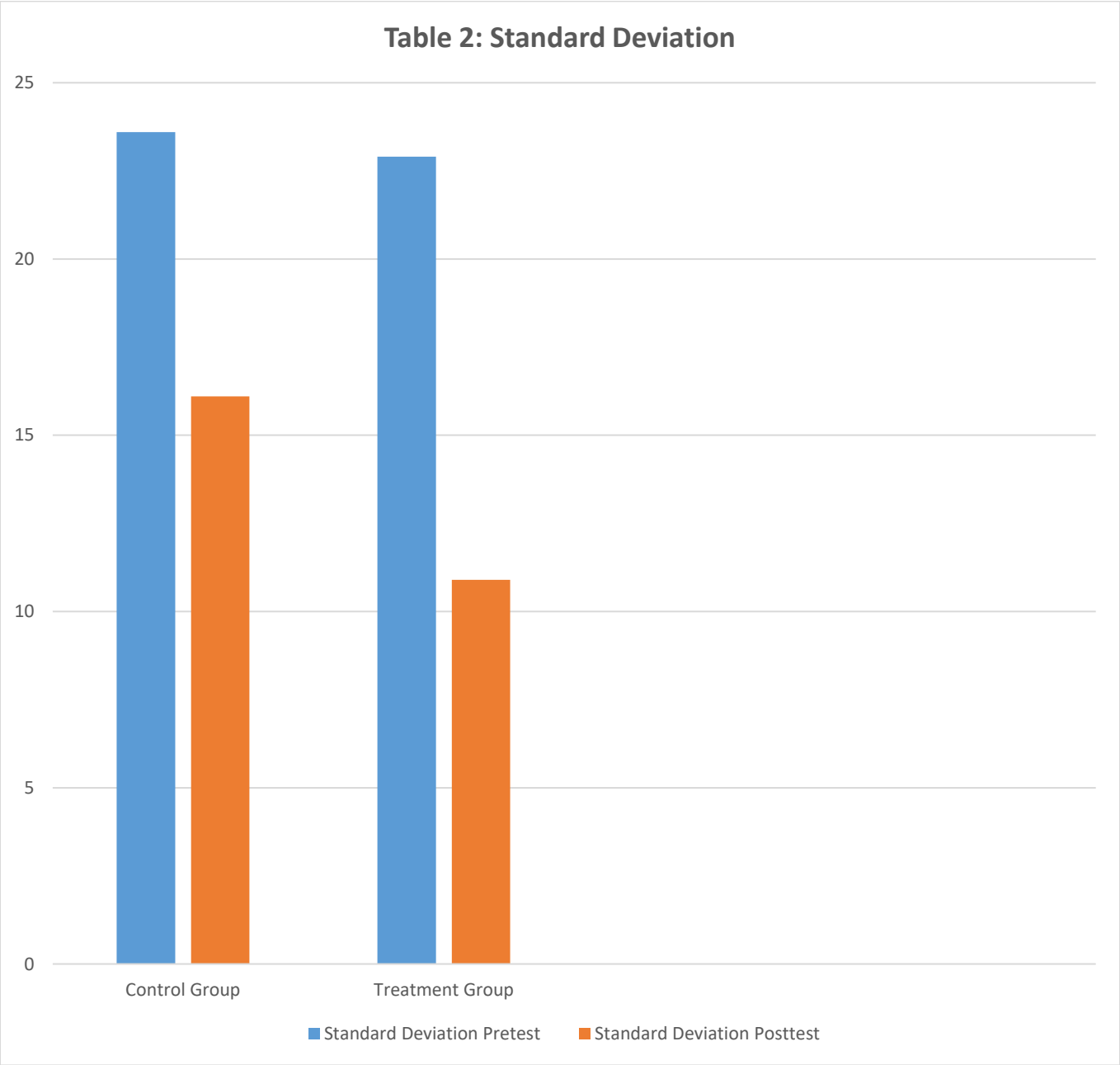
Table 2: Standard Deviation
25
20
15
10
5
0
Control Group
Treatment Group
Standard Deviation Pretest
Standard Deviation Posttest

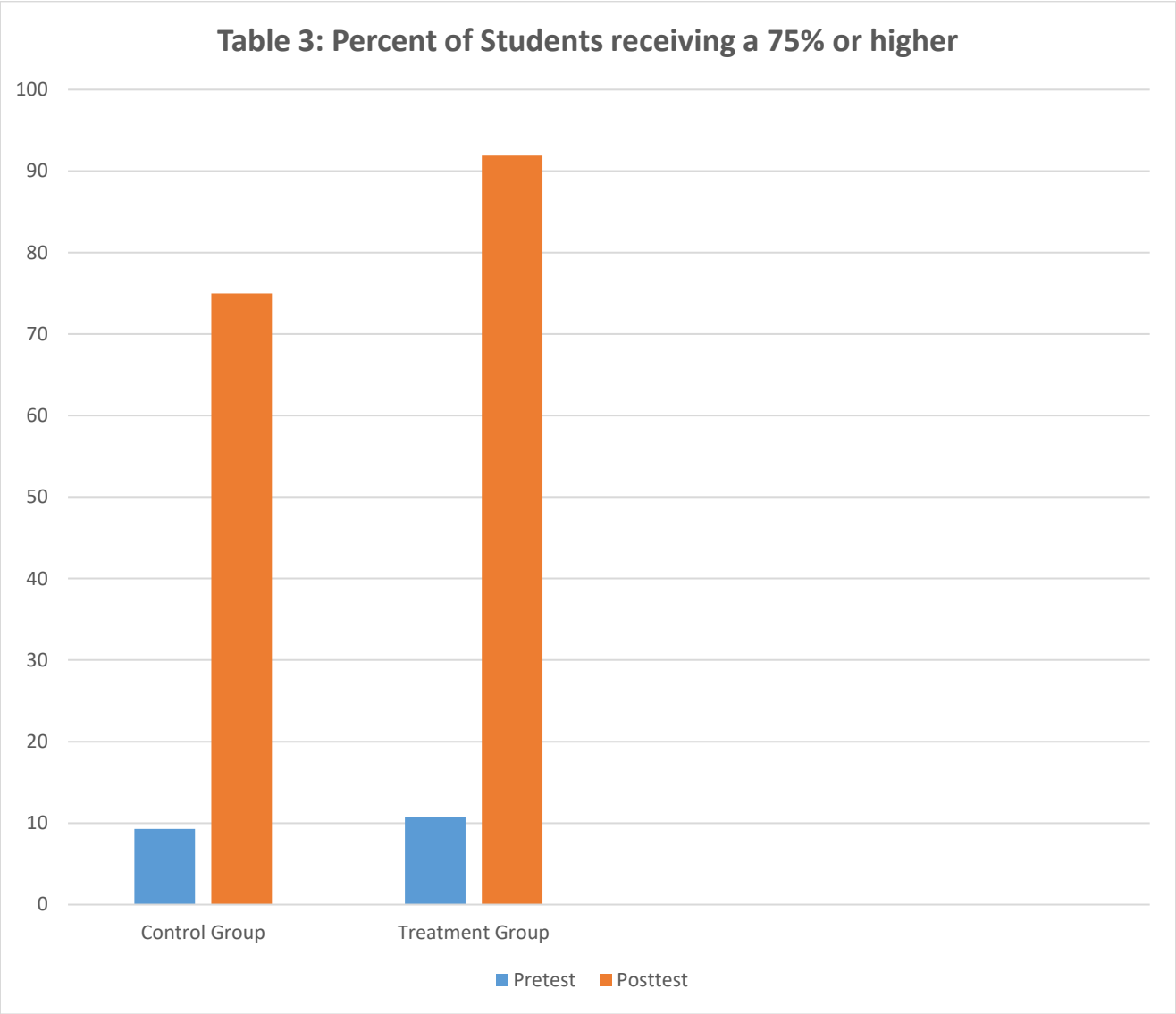
Table 3: Percent of Students receiving a 75% or higher
100
90
80
70
60
50
40
30
20
10
0
Control Group
Treatment Group
Pretest
Posttest

Discussion

Summary of Major Findings

The results of this action research study show guided math paired with math stations result in a higher classroom mean score compared to a whole group, traditional method of teaching. The classes who took participated in guided math had an average of 91.1% on the posttest, and the classrooms who continued with a whole-group, traditional teaching approach had an average of 83.8%. This data shows guided math paired with math stations can result in higher test scores. Research collected on small groups, blended learning, and cooperative learning also supported these results.

Results also show classrooms who implement guided math paired with math stations have lower standard deviation. This means a smaller gap between high achieving students and struggling students is evident. Guided math can give teachers time in small group instruction to catch the struggling students up to reduce the achievement gap.

The focus of this action research study was to determine if students who were in guided math had more growth than students who were in a traditional classroom. According to the results, students in a guided math classroom did not have more growth than students in a traditional classroom. Students in the traditional classroom had 57% growth compared to 51% growth in the guided math classrooms. Even though there was more growth for students in the traditional classroom, students in the guided math classrooms outperformed the students in the traditional classrooms on the posttest. The data shows many positive outcomes from implementing guided math. Students can have higher test scores, the achievement gap is lessened, and more students in the classroom succeed.

Limitations of the Study

Limitations to the study could affect the reliability of the results. The first limitation is the sample of students. It was a relatively small sample size with not a lot of diversity. 100% of the sample size involved white, middle to upper-class students. Therefore, the results could be different for a larger, more diverse sample size.

The researcher was also one of the lead teachers in the treatment group. Therefore, the researcher could show unintended bias towards the treatment group. The two teachers in the treatment group were younger with less experience than the two teachers in the control group. This could have also impacted the results of the study.

Lastly, every classroom is different. Even though The T-Test: Two Sample Equal Variance showed no significant difference between the control and treatments groups on the pretest, the test did not show the whole picture. Some of the classrooms were less motivated than others, and no test could have shown this. Also, not all 5^{th} grade students were able to participate in the study because of sickness. Several students missed the posttest due to Covid-19. Because they missed the test, they were taken out of the study. These missing students could have altered the results.

Further Study

Further research needs to be completed with a larger sample size for a longer period of time. During this action research, guided math was only implemented for one, four-week unit. It would be interesting to see results presented after implementing guided math for a longer period of time.

The sample size was also very small. This sample size consisted of 69 fifth-grade students in a private school. 100% of the students were white, and most came from middle to upper class homes. Further research should be completed with a more diverse sample group which also consists of multiple grade levels.

Further research should be conducted to see if student engagement increased because of math stations. Research for small groups, cooperative learning, and blended learning all show increased engagement, but does the specific math station model increase engagement? Research needs to be conducted to determine if math stations promote more student engagement compared to the traditional, whole group teaching method.

Lastly, more research should be conducted to see how math station impact students' self-efficacy. Do students who are in a guided math classroom feel like they have learned more than students in a traditional classroom? Research needs to be conducted to see how guided math impacts students' beliefs about themselves, their success, and their attitudes about math.

Conclusion

This study was conducted to determine if guided math paired with math stations resulted in more mathematical growth than traditional, whole group teaching methods. The results of the study showed students in a guided math classroom did not statistically have more mathematical growth, but the study showed other benefits. Students in guided math classrooms outperformed their peers in traditional classrooms, and the achievement gap between struggling and high achieving students was lessened. Guided math paired with math stations allow students to participate in blended learning, small groups, and cooperative learning. Guided math includes all three of these learning opportunities, and research shows these three opportunities promote higher achievement, higher engagement, and collaboration skills.

References

Aftab, J. (2015). Teachers' beliefs about differentiated instructions in mixed ability classrooms: a case of time limitation. *Journal of Education and Educational Development*, *2*(2), 94–114.

Altun, S. (2015). The effect of cooperative learning on students' achievement and views on the science and technology course. *International Electronic Journal of Elementary Education*, *7*(3), 451–468.

Alvi, E., & Nausheen, M. (2019). Examining Grade 9 Students' Engagement in Mathematical Problem-Solving (MPS) When Working as Individuals and in a Small Group Settings. *Bulletin of Education and Research*, *41*(1), 163. http://ezproxy.nwciowa.edu/login?url=https://www.proquest.com/scholarly-journals/examining-grade-9-students-engagement/docview/2266868662/se-2?accountid=28306

Benders, D., & Craft, T. (2016). The effect of flexible small groups on math achievement in first grade. *Networks: An Online Journal for Teacher Research*, *18*(1).

Capar, G., & Tarim, K. (2015). Efficacy of the cooperative learning method on mathematics achievement and attitude: a meta-analysis research. *Educational Sciences: Theory and Practice*, *15*(2), 553–559.

Dietrich, T., & Balli, S. J. (2014). Digital natives: fifth-grade students' authentic and ritualistic engagement with technology. *International Journal of Instruction*, *7*(2), 21–34.

Enu, J., Danso, P. A., & Awortwe, P. K. (2015). Effects of group size on students mathematics achievement in small group settings. Journal of Education and Practice, 6(1), 119–122.

Eryilmaz, M. (2015). The Effectiveness Of Blended Learning Environments. *Contemporary Issues in Education Research (Online)*, *8*(4), 251. http://dx.doi.org/10.19030/cier.v8i4.9433

Frederique, B., Ha, L. L. T. V., McDonald, S., Clara, N., & Jandug-Montera Lilibeth. (2020). Defining student learning experience through blended learning. *Education and Information Technologies*, *25*(4), 3049-3069. http://dx.doi.org/10.1007/s10639-020-10100-y

Gaffner, J., Johnson, K., Torres-Elias, A., & Dryden, L. (2014). Guided reading in first-fourth grade: theory to practice. *Texas Journal of Literacy Education*, *2*(2), 117–126.

Gavin, M. K., Casa, T. M., Adelson, J. L., & Firmender, J. M. (2013). The impact of challenging geometry and measurement units on the achievement of grade 2 students. *Journal for Research in Mathematics Education*, *44*(3), 478–509.

Herrmann, K. J. (2013). The impact of cooperative learning on student engagement: results from an intervention. *Active Learning in Higher Education*, *14*(3), 175–187.

Hunter, R., & Anthony, G. (2014). Small Group Interactions: Opportunities for Mathematical Learning. *North American Chapter of the International Group for the Psychology of Mathematics Education*.

McCollum, T. (2019). *A Comparison of a Station Rotation Blended Learning Classroom to a Traditional Classroom Using NWEA MAP* (Order No. 13878915). Available from ProQuest Central; Social Science Premium Collection. (2228376963). http://ezproxy.nwciowa.edu/login?url=https://www.proquest.com/dissertations-theses/comparison-station-rotation-blended-learning/docview/2228376963/se-2?accountid=28306

McKeen, H. (2019). The impact of grade level flexible grouping on math achievement scores. Georgia Educational Researcher, 16(1), 48–62.

Musti-Rao, S., & Plati, E. (2015). Comparing two classwide interventions: implications of using technology for increasing multiplication fact fluency. *Journal of Behavioral Education*, *24*(4), 418–437.

NWEA. (2022). *NWEA*. NWEA UAP Login. Retrieved February 11, 2022, from https://teach.mapnwea.org/admin/home.seam

Rubenstein, L. D. V., Gilson, C. M., Bruce-Davis, M. N., & Gubbins, E. J. (2015). Teachers' reactions to pre-differentiated and enriched mathematics curricula. *Journal for the Education of the Gifted*, *38*(2), 141–168.

Smith, T. J., McKenna, C. M., & Hines, E. (2014). Association of group learning with mathematics achievement and mathematics attitude among eighth-grade students in the us. *Learning Environments Research*, *17*(2), 229–241.

Webel, C., & Dwiggins, A. D. (2019). Prospective elementary teachers' experiences with and perspectives on grouping by ability in mathematics. Mathematics Teacher Education and Development, 21(2), 4–23.

Zhang, M., Trussell, R. P., Gallegos, B., & Asam, R. R. (2015). Using Math Apps for Improving Student Learning: An Exploratory Study in an Inclusive Fourth Grade Classroom. *TechTrends*, *59*(2), 32-39. http://dx.doi.org/10.1007/s11528-015-0837-y